

LOCATION MANAGEMENT OF A WIRELESS TERMINAL

FIELD OF THE INVENTION

The invention relates to supporting the mobility of wireless terminals, such as DECT telephones, in a telephone network.

BACKGROUND OF THE INVENTION

With reference to Figure 1, wireless terminals, such as DECT telephones, as described in ETSI Standard 300 175 Radio Equipment and System: Digital Cordless European Telephone, Common Interface, Sections 1 to 9, can be connected to a Public Integrated Services Network PISN. The DECT System comprises a base station FP (Fixed Part), usually connected to the PISN via a Private Branch Exchange PBX. There are three main types of base stations FP: a home base station or a base station to be connected to an office PBX and so-called telepoint base stations. In a conventional wired telephone network, e.g. signalling protocols DPNSS and DSS.1 are used, which are described in the CCITT (now ITU) Specification: "DSS.1, Q.930 to Q.940, 1989, Digital Subscriber Signalling System No. 1, Network Layer, User-Network Management". These signalling protocols support the mobility of the subscriber very poorly or not at all.

To support the subscriber mobility, services of a PBX network can be supplemented with Intelligent Network (IN) technique determined e.g. in the specifications of ITU Q.1200 series. By IN technique, it is possible to combine telecommunications networks of different types, such as the PISN and cellular mobile systems, e.g. GSM and NMT, not shown separately in Figure 1. The principle of IN technique is that the signalling needed for establishing a speech connection takes place controlled by the IN, but the actual speech connection is switched by known functions of the communications network in question.

One of the services provided by the IN is Follow Me Destination (FMD) call transfer. By means of this service, the subscriber may control his incoming calls to a desired number, which can be e.g. an extension number of the PBX network or a mobile network number. In Figure 1, for example, a Terminal Equipment TE1 user moving from a first DECT system DECT1 to a second system DECT2 may order a call transfer to an extension number of this second system.

The main problem with the solution described is that a call transfer requires activity and carefulness of the subscriber. In solutions of the prior art, the subscriber has to know the extension number to which calls shall be transferred and to remember to give this information to the operator.

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SUMMARY OF THE INVENTION

The object of the invention is to develop a method and an equipment implementing the method in such a way that the above problems with the subscriber mobility and location management can be solved. The objects of the invention are achieved by a method and a system, which are characterized in what is set forth in the independent claims. Preferred embodiments of the invention appear from the dependent claims.

The invention is based on the fact that subscriber location data are maintained by means of IN technique. Signalling between a telephone exchange and a PBX is supplemented with extra information on the location of the subscriber terminal.

An advantage of the method and system of the invention is an improved support to the mobility of the subscriber. The subscriber does not need to determine separately the extension number to which he wishes to transfer his calls. It is enough that the subscriber starts his phone in the area of a new PBX. The invention does not require changes in existing terminals. The invention can also be applied to double-mode terminals, such as GSM/DECT telephones, which means that the invention saves radio resources, since the greatest possible part of the signalling takes place via a wired telephone network.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in greater detail by means of preferred embodiments with reference to the attached drawings, in which

Figure 1 shows such parts of a known telecommunications system which are substantial for the understanding of the invention;

Figures 2A and 2B show a location updating according to the invention in a DECT system; and

Figure 3A shows signalling in case of a mobile terminated call; and

Figure 3B shows signalling in case of an internal call in a PBX.

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DETAILED DESCRIPTION OF THE INVENTION

With reference to Figure 1, the invention suggests that the functionality of a PBX is supplemented in a way which is to some extent analogous with the home and/or visitors location register of mobile systems. A home PBX (HPBX) is allocated to each subscriber of a wireless system. In this application, a PBX other than HPBX is called a Visited PBX (VPBX). Each PBX comprises both HPBX and VPBX functionality. Within the scope of this application, a transmitting exchange EXC is any exchange via which the PBXs are connected to the PISN and/or mobile networks. The EXC is supposed 1) to have an interface to the PBXs for a speech connection, 2) to support an interface to a Service Switching Point SSP of the IN for a signalling connection and 3) to support the INAP signalling protocol extended for this purpose (INAP extensions).

According to the invention, a roaming number ROAM# is allocated to a subscriber moving to the area of a VPBX. In the numbering plan, a fixed area can be reserved from the number space of said PBX for the roaming numbers. In this way, it is possible to avoid consuming the numbers of the PISN.

A functionality supporting subscriber mobility can be implemented for instance by a suitable addition to the conventional call setup protocol between the PBX and the EXC. Messages used for call setup may include an extra packet EI (Extra Information). The EI packet can be coded in different ways in different signalling protocols. In case of the DSS.1 protocol of the example, suitable information elements are e.g. FACILITY and USER_TO_USER. A separate specific field can also be defined for this purpose. The extra packet EI is transparent to the EXC (the exchange does not react to it). The purpose of the EI packet is to support the subscriber's mobility in such a way that an information on the subscriber's location can be transmitted via the SSP of the IN to a Service Control Point SCP of the IN. On the other hand, the SCP maintains data in a Service Data Point SDP. By means of the extra packet, information on subscriber identification or authentication, for instance, can be transferred.

A logic interface between the PBX and the IN - especially its SCP - comprises two functionalities according to the invention: location updating and location cancellation.

At Location Updating LU, the VPBX informs the SCP of the IN that the terminal TE tries to register to the area of a new PBX. Upon receiving this information, the SCP checks from the SDP the subscriber data and especially whether said subscriber has the right to use the services of the new VPBX.

- 5 At Location Cancellation LC, the SCP removes from the SDP the information on that the terminal TE is in the area of the VPBX.

Figure 2A shows a possible signalling when a terminal registers to the area of a VPBX. To keep the figure illustrative, only steps essential for the invention are shown. In this application, reference numerals 2A-1, 2B-1, etc. 10 signify corresponding steps in Figures 2A, 2B, etc.

- In step 2A-1, the terminal TE sends to the VPBX a Location Update Request including the identity of the TE or its subscriber. It is assumed initially that the identity is e.g. an International Portable User Identity IPUI. The VPBX notices that said terminal is not registered to this PBX and that the HPBX of 15 the terminal is other than the VPBX. Therefore, a calling subscriber's roaming number (CLG#ROAM#, Calling Number Roaming Number) is allocated to the terminal. The roaming numbers are preferably reserved from the number space of the PBX. In this way, it is possible to avoid consuming the numbers of the PISN.

- 20 In step 2A-2, the PBX sends the EXC a call setup request SETUP including, in addition to the number of the called subscriber, i.e. subscriber B, also the roaming number allocated in step 2A-1 and the above-mentioned extra packet EI. The EI packet includes the information on that the type of the task is location updating LU of a terminal/subscriber whose identity is IPUI. 25 The EXC performs a number analysis of the called subscriber number and notices that an IN service request has to be made for location updating of the terminal TE in the SDP of the intelligent network.

- In step 2A-3, the EXC sends a service request INVOKE to the SCP of the IN. This joins together the identity of the terminal or its subscriber, such 30 as the IPUI number, and the subscriber number of the terminal, such as the TE_MSISDN number, which is returned to the EXC in a Connect message in step 2A-4. In step 2A-5, the EXC sends the HPBX a location cancellation message LC, which can be for instance a call setup request SETUP supplemented with an extra packet EI according to the invention. The EI packet in- 35 cludes in this step an information on that the subscriber location of the terminal in the area of the HPBX is cancelled. In step 2A-6, the HPBX sends an ALERT

message to the EXC. In step 2A-7, the EXC sends a corresponding ALERT message to the VPBX, which in step 2A-8 acknowledges the location updating of the terminal TE. In steps 2A-9 and 2A-10, the signalling connections are cancelled.

- 5 If an International Portable Equipment Identity IPEI is used instead of the subscriber's IPUI, the signalling functions as described above, except that the location data of the physical terminal TE are maintained, instead of those of the subscriber. By implementing the location management of the invention by means of the signalling relating to a call setup, the existing signalling and the SCP interface can be used without any great changes.

10 If the TE moves from the area of a first VPBX into the area of a second VPBX, the signalling takes place as above, except that the location cancellation LC is sent to that VPBX where the subscriber's IPUI (or the IPEI of the terminal) last was updated.

- 15 Figure 2B shows the signalling in case if the TE returns to the area of its HPBX. The signalling corresponds to the steps described in connection with Figure 2A, but the tasks of the HPBX and VPBX are inverse during the steps 2B-1 to 2B-9. The steps 2A-n and 2B-n can be indicated by a common marking 2x-n. The location of the TE is updated from the VPBX to the HPBX.

- 20 With reference to Figure 3A, it is assumed that the terminal TE receives a call, when it is within the area of a VPBX. In case of an incoming call, the signalling takes place as follows. In step 3A-1, a call comes to an EXC from another exchange EXC2 not shown, which can be an exchange of the PISN or equally well a mobile network exchange. In step 3A-2, the EXC sends
25 the SCP of the IN a service request INVOKE including the TE_MSISDN number of the terminal. In step 3A-3 the SCP returns to the EXC a roaming number CLD#ROAM# allocated to the terminal. In step 3A-4, the EXC concludes from the roaming number that the TE exists in the area of the VPBX and sends said PBX a call setup request. The steps 3A-5 to 3A-10 correspond to
30 conventional call setup. In step 3A-5, the terminal TE is paged and, in step 3A-6, it responds to the paging, etc. In step 3A-10, the EXC sends an Access_Complete Message to the other exchange EXC2.

- Figure 3B shows signalling in case of an internal call in an HPBX of a DECT system. It is assumed that subscriber A is TE1 and subscriber B is
35 TE2, respectively. The signalling takes place in the same way as in a conventional DECT call. No service request to the SCP of the IN is needed, because

the HPBX notices in step 3B-2 that the subscriber B is in the area of the same PBX and can start paging according to the prior art. If the subscriber B were in the area of a VPBX, the signalling would take place in the same way as in Figure 3A, but the call would be started from the terminal TE1 of the subscriber A, instead of starting from the EXC2.

5 A physical implementation of the invention presupposes that location updating and call setup messages according to the prior art are supplemented with extra information elements of the invention. This is implemented in the easiest way by changes in software. To be precise, the arrangement of the invention comprises the following changes:

- 10 - a PBX comprises means for indicating location information for a terminal TE of a wireless network;
- the PBX comprises means for adding the location information and the identity (IPUI/IPEI) of the TE to a call setup message SETUP;
- 15 - an EXC comprises means for sending the location information and the identity of the TE to a node SCP of an IN in connection with a service request INVOKE;
- the node SCP of the IN comprises means for adding the location information and the identity of the TE to the ISDN number of the TE.

20 The invention has been described by way of example in connection with the DECT system and assuming that DSS.1 signalling is used between the PBXs and the exchanges. On the basis of the above description, it is easy for one skilled in the art to apply the invention to other wireless telephone systems as well. It is also clear that the invention is equally suitable for location management of all kinds of mobile terminals, not only of a telephone. The invention and its embodiments are thus not restricted to the above examples, but they can vary within the scope of the claims.